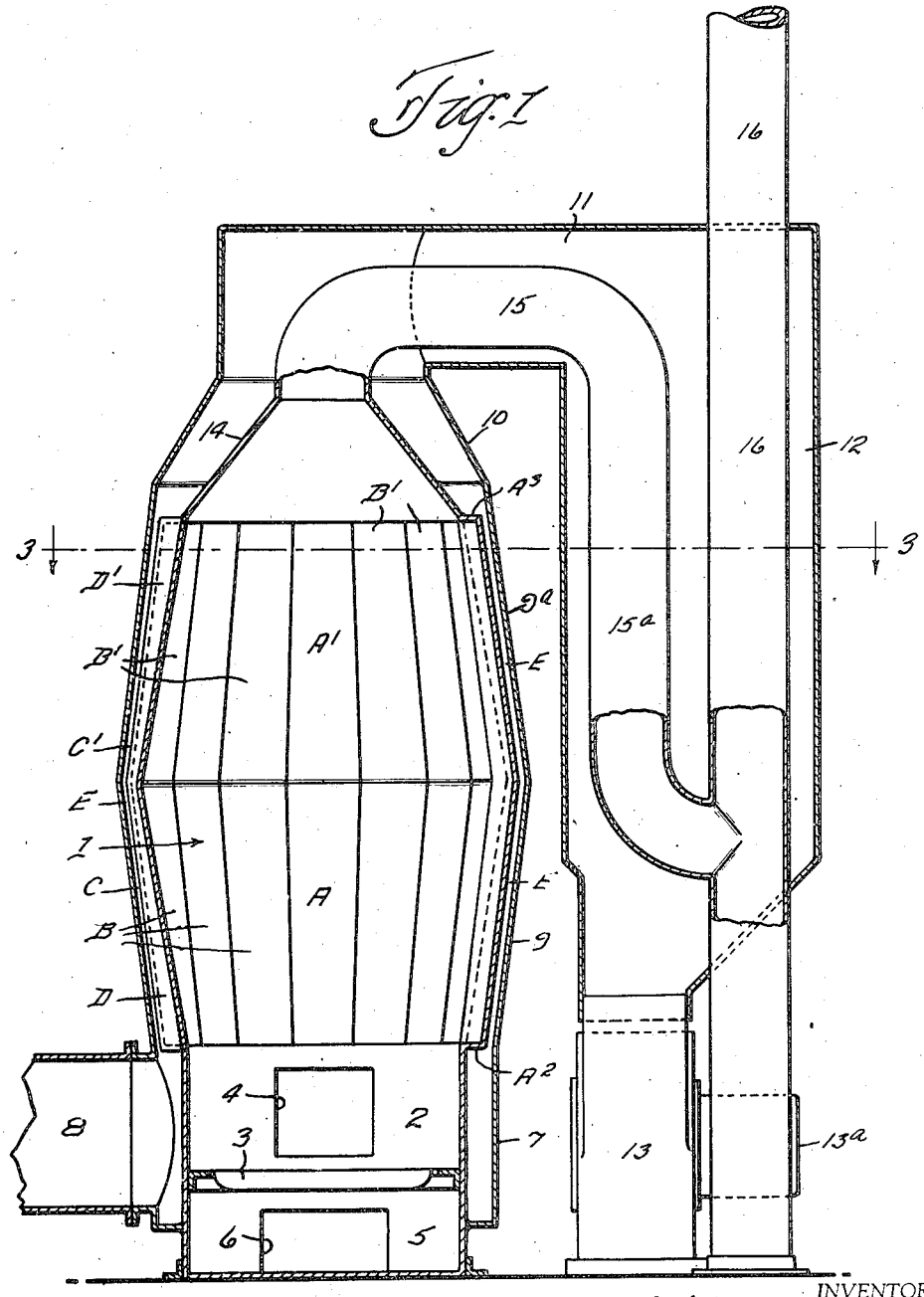
Dec. 27, 1938. H. E. GRILL ET AL 2,141,649

FURNACE INSTALLATION

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Fig. 1



INVENTORS.

Harry E. Grill
Henry H. Feldstein,
Hull, Brock & West.

BY

ATTORNEYS.

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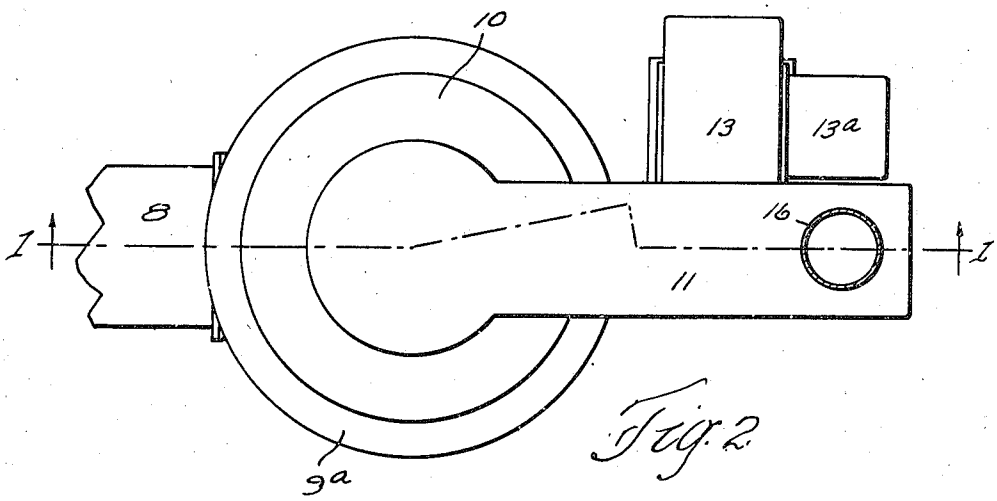


Fig. 2.

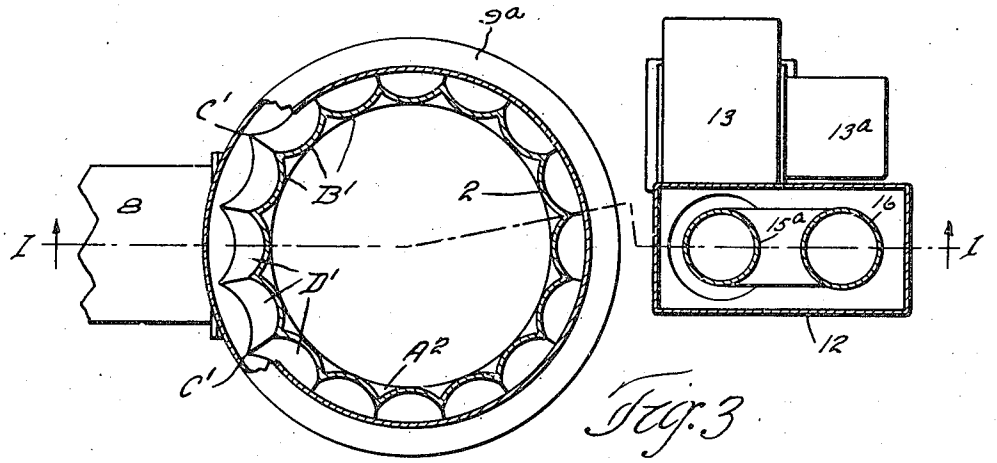


Fig. 3.

INVENTORS,
Harry E. Grill,
Henry H. Feldstein,
BY Hull, Brock & West.
ATTORNEYS.

Patented Dec. 27, 1938

2,141,649

UNITED STATES PATENT OFFICE

2,141,649

FURNACE INSTALLATION

Harry E. Grill, Willoughby, and Henry H. Feldstein, Cleveland, Ohio, assignors to The Kilby Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application December 22, 1937, Serial No. 181,110

3 Claims. (Cl. 126—110)

This invention relates to air heating furnaces, and has for its general object to provide a furnace installation wherein the furnace will possess high heating capacity and will combine such capacity with a correspondingly high efficiency in operation.

Further and more limited objects of the invention will appear hereinafter and will be set forth in connection with the detailed description of the drawings hereof, wherein Fig. 1 represents a vertical sectional view through a furnace installation constructed in accordance with our invention, the section corresponding substantially to the lines 1—1 on Figs. 2 and 3; Fig. 2 a plan view of the furnace shown in Fig. 1; and Fig. 3 a detail in section taken on the line 3—3 of Fig. 1, with a part of the external casing broken away.

Describing by reference characters the various parts shown in the drawings, 1 denotes the combustion chamber, 2 the firebox, and 3 the grate of our furnace, the firebox being provided with a door, indicated at 4. Below the grate is the ash pit 5 having a door 6.

The combustion chamber comprises a lower inverted frusto-conical section A and an upper frusto-conical section A', these sections being symmetrical, with the top of section A and bottom of section A' united into a continuous body having its greater maximum diameter at the junction of the two sections. Each of these sections is provided with inwardly extending corrugations B and B' respectively. These corrugations increase progressively in width and decrease progressively in depth from the bottom of section A and the top of section A' toward the middle of the combustion chamber, where the diameter of the latter reaches its maximum.

In practice, we have constructed the combustion chamber by first forming steel strips each having a corrugation co-extensive therewith; by welding together the adjacent edges of the said strips; by supporting the lower ends of the corrugated strips which are to form the section A by welding thereto a ring A^2 and by supporting in like manner the upper ends of the strips which are to form the section A' by welding a ring A^3 thereto. These rings are cut out to conform substantially to the contour of the lower and upper ends of the sections A and A', respectively; and these sections are united, as by welding, to form the combustion chamber proper.

Surrounding the combustion chamber and extending above and below the same is a casing by means of which air is conducted downwardly through the channels provided between the casing and the corrugations of the combustion chamber. This casing comprises a bottom section 7 surrounding and spaced from the firebox and the upper portion of the ash pit and having connected thereto a conduit 8 by means of which heated air is conducted to the point or points of use. It also comprises a lower inverted frusto-conical section 9 and an upper frusto-conical section 9^a, the two sections being symmetrical, with the top of the section 9 and the bottom of the section 9^a united, as by welding, to form a continuous body. The sections 9, 9^a surround the sections A, A', respectively, and are closely adjacent to but spaced from the ribs C, C' of the corrugations thereof, thereby forming an air-heating conduit surrounding the combustion chamber and comprising the passageways D, D' through which the major portion of the air passes, and a thin annular passageway E surrounding the ribs through which the minor portion of the air passes. The upper section 9^a of the casing merges with a frusto-conical dome 10 which communicates at its top with a conduit comprising a substantially horizontal section 11 and a vertical casing section 12. Air is supplied to the bottom of 12 by means of a blower located in a casing 13, the blower being driven by a motor, indicated at 13^a. The ring A^3 is welded to a frusto-conical extension 14 of the combustion chamber and the ring A^2 is welded to the wall of the firebox. The products from the combustion chamber section A, A' are directed through the frusto-conical extension 14 into a flue comprising a substantially horizontal section 15 located in the conduit section 11 and a downwardly extending section 15^a located within the conduit casing section 12 and communicating at its bottom with the vertically extending stack 16, the lower section of which constitutes a part of the flue and is also located within the conduit section 12. The dome 14, the flue 15, 15^a, and the portion of the stack flue 16 within the casing 12 are of metal, whereby an efficient interchange of heat may be effected between the products delivered from the combustion chamber and the air supplied to the passageways D, D', and E.

With the parts constructed and arranged as described, the operation will be readily understood. The air to be heated is delivered by the blower into the conduit sections 12 and 11, thence downwardly between the dome 10 and the top 14 of the combustion chamber, thence mainly through the passageways D, D' and to a less extent through the annular passage E surrounding the former passageways, and thence through

the annular chamber within the casing section 7, whence it is delivered into the offtake conduit 8.

Due to the construction of the combustion chamber, and more particularly to the shape given to the passageways D, D' and E through which the air passes while being heated, we have been able to effect a very high efficiency in the transfer of heat from the combustion chamber to the air being forced through the passageways surrounding the same and to effect the heating of an unusually large volume of air per unit time in comparison with the size of the combustion chamber.

This efficiency in the transfer of heat is due, not only to the large radiating surface of the combustion chamber (due to the corrugations), but also to the fact that, due to the shape of the passageways constituting the conduit through which the air is conducted around the combustion chamber, turbulence is imparted to the air while in transit, which turbulence also facilitates the transfer of heat from the combustion chamber to the air in said conduit.

In an actual installation which we have made, the combustion chamber is made from plates or strips of $\frac{5}{16}$ inch steel, said strips having parallel side edges prior to the corrugating thereof. The corrugations are approximately 3¾ inches in depth at the narrow ends thereof and diminish to approximately 3⅓ inches at the widened ends thereof.

Reference has been made heretofore to the narrow width of the annular passageway E. In the installation referred to, the outer shell 9, 9ª is spaced approximately one inch from the ribs between the corrugations in a furnace wherein the combustion chamber is 8½ feet long and has a major diameter of 6¼ feet.

Due to the shape of the ribs, they tend to heat most effectively by convection the air contained within the narrow annular passageway E.

Furthermore, the efficiency of our installation in heating air is enhanced by the construction whereby the entering air is conducted in contact with the flue sections 15, 15ª and the stack flue 16 before being delivered through the passageways D, D' and E.

Having thus described our invention, what we claim is:—

1. In a furnace, the combination of a combustion chamber comprising substantially symmetrical end sections increasing progressively in diameter toward the middle portion thereof, the said combustion chamber being provided with continuous corrugations extending from end to end thereof, the corrugations being each of progressively increasing width from its ends to the middle thereof, a shell surrounding the combustion chamber in close proximity to but spaced from the ribs formed between the corrugations of the combustion chamber thereby to provide an air-heating conduit consisting of circumferentially spaced passageways merging with a narrow annular passageway of substantially uniform width from end to end thereof, there being an outlet receiving heated air delivered from the delivery ends of said passageways, and means for forcing air into the opposite ends of said passageways.

2. In the combination recited in claim 1, the combustion chamber being substantially vertical and the means for supplying air communicating with the upper ends of the passageways and the outlet for heated air communicating with and receiving air from the bottoms of the said passageways.

3. In the combination recited in claim 1, the corrugations decreasing progressively in depth toward the middle thereof.

HARRY E. GRILL.
HENRY H. FELDSTEIN.